6. *Duration of the Treatment.* This will vary from a few months to several years. It should be continued, or, at least, the patient should be kept under observation, as long as disease is present, and should be watched closely afterward. The treatments may be given in series, allowing varying intervals depending upon the condition of the patient.

CONCLUSIONS. 1. Cases that are operable should be operated upon, and this should be followed by early and thorough postoperative Röntgen-ray treatment.

2. Sarcomas yield better to the x-rays than carcinomas. In sarcoma it seems from the foregoing results that we may hope for 50 per cent. of recoveries. In the series reported, 65 per cent. have recovered.

3. Localized recurrent carcinoma will usually yield to the Röntgen rays, unless the mucous membrane be involved.

4. Occasionally good results are obtained even in advanced cases of carcinoma, but generally one can hope only for palliation or prolongation of life.

5. Good results will depend very much upon good technique.

I am indebted to the physicians who have referred the patients for treatment, and to Dr. Henry S. Wieder, surgical pathologist to the Medico-Chirurgical Hospital, who made the pathological examinations.

IS PERCUSSION AS A METHOD OF TESTING THE LUNGS DESERVING OF GREATER ATTENTION?[1]

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THE thoughtful observer can hardly fail to have noticed that the two methods commonly employed for testing the lungs, percussion and auscultation, as they are now taught and practised, differ fundamentally from each other in one respect: in auscultation the usual procedure is to apply the stethoscope to a certain spot on the thorax and then directly to observe the character of the respiratory sound, the inspiration, the expiration, rales, etc. In percussion, on the other hand, it is not the character of the percussion sound which is regarded as of primary importance, but with an earnestness and enthusiasm, worthy of more weighty objects, the importance of percussing symmetrically and comparing the percussion sounds at symmetrically situated spots is taught and practised. It is true that phenomena of auscultation are also studied by the symmetrical-comparative method, but this is merely a subsidiary procedure, which ensues after the character of the respiratory sound has been determined, and thus not until a necessary foundation has been laid, without which the comparison would be quite valueless. The symmetrical-comparative method at presents enjoys far too great a vogue to the prejudice of percussion as such and its development in the future. As a rule, the investigation does not proceed farther than to the examination of the difference in the percussion sound at two particular spots which are compared, and consequently sticks at that point, not advancing to the really essential point of the percussion, that is, the determination of the special character of the percussion sound itself, that is, to a judgment analogous to that pronounced in the case of auscultation.

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[1] Read at the International Congress on Tuberculosis, Washington, D. C., September-October, 1908.

The symmetrical-comparative method is obviously inadequate for establishing how far dulness is present or for determining the degree of dulness, as long as the character of the percussion sound (non-tympanitic, tympanitic, more or less dull, etc.), with which the sound under examination is being compared, has not previously been ascertained. The method of auscultation has, as I have already pointed out, a decided advantage at this stage. Having this firm ground to build on, auscultation precludes the occurrence of such errors as declaring that no alteration of the respiratory sound is present, simply because the symmetrical-comparative auscultation has not shown any difference in the respiratory sound at the points which are being compared, whether the sound is vesicular, bronchial, amphoric, or whatever it may be. In percussion, on the other hand, analogous errors as regards, for example, the existence of dulness, are quite conceivable, and as a matter of fact, as I have shown,[2] are of frequent occurrence. And these shortcomings can never be got rid of until the essential element in percussion, that is, the determination of the character of the percussion sound, is put in the first place, and the symmetrical-comparative method now in vogue is relegated to a secondary position.

The defects of the symmetrical-comparative method are in the main as follows: (1) If there is dulness in the percussion sound at two symmetrical spots, and the difference in the degree of dulness is indistinct, as is not infrequently the case, the dulness may remain unnoticed at both spots. (2) If there is dulness in the percussion sound at two symmetrical spots, and the difference in the degree of dulness is distinct, which often occurs, the dulness at the spot where the degree of dulness is greater may be miscalculated, that is, underestimated, and the dulness at the other spot may be neglected altogether.

It is a vital matter for present-day diagnostics not merely to be able to decide the question, "tuberculosis or not?" or, so to speak, to make a qualitative diagnosis, but also to determine at what stage the disease is, that is, to make a quantitative diagnosis. For this latter purpose it is necessary to determine the degree of dulness as well as the existence of dulness itself, to decide, for instance, whether a high or a low degree of dulness[3] is present.

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[2] En studie i perkussion af lungorna, Hygiea, 1904, p. 125.

To those who have not thought over the matter carefully or have not had an opportunity of testing and comparing the pronouncements of various investigators on the dulness and degree of dulness, it might seem that the task is comparatively simple. One author[4] even ventures to assert, that if the dulness be more distinct, for example, D^3, D^4, and D^5 (see below), it would be impossible for two observers to hold different opinions. My investigations have shown that just the reverse is the case; that in the question as to dulness great confusion prevails, that different observers, on the contrary, often arrive at widely different results even, and, indeed, as I shall explain later, especially with regard to the high degrees of dulness.

It is impossible for us to escape from this regrettable fact, which must be patent to all who will take the trouble to study the evidence. The explanation lies ready to hand: (1) As I have shown in the symmetrical-comparative percussion method, an existing dulness is often ignored or underestimated; (2) the judgment is dependent on the investigator's more or less trained, more or less keen, susceptibility to sound; and (3) there exist no recognized definitions for degrees of dulness in lung percussion. Under the present conditions this aspect of percussion lies to such an extent at the mercy of subjectivity that, practically speaking, it has hardly any value at all. No wonder then that we are continually hearing auscultation praised at the expense of percussion, and that some even go so far as to assert that the former method may be used to check the latter.[5] It is owing to the misuse of the symmetrical-comparative method that percussion, as a whole, has fallen into discredit. Percussion still remains a quite independent method of investigation, which permits as little of checking by means of auscultation as vice versa. But this would lead me into the question whether both these methods and others besides are not required for a determination of the state of the lungs, a question which I need not enter into here.

Another defect of the symmetrical-comparative method, which is a corollary of those above mentioned, has been even less observed than they: that is, that the degree of dulness in general, and more especially when it is considerable, is regularly underestimated, and to such extent is this so that it is actually a very rare occurrence

[3] Turban-Gerhardtsche Stadieneintheilung d. Tuberculosis, Kaiserl. Gesundheitsamt, 1907, p. 560.

[4] O. V. Petersson, Om tuberkulinprofoet och tidigdiagnosen af lungtuberkulos, Upsala, läkarefören. forhandl., Band ix, Heft 5 and 6.

[5] Israel Rosenthal, Hvorledes bör man perkutere Lungerne? Bibl. for Læger, 1904, p. 479.

to find a high degree of dulness registered, for example, in medical reports.

A little reflection will easily guide one to the explanation, if we bear in mind: (1) That the attention in the symmetrical-comparative method of percussion is directed to the difference in the dulness of the percussion sound at the two points which are being compared; (2) that in cases of tuberculosis of the lungs dulness regularly occurs on both sides of the lungs;[6] and (3) that the difference in the degree of dulness at symmetrical points is comparatively slight. Assume, for instance, that on the right side we find the degree of dulness D^3 and on the left D^2. The difference between D^3 and D^2 is D^1, from which we judge that a low degree of dulness is found on the right side. Or, again, we find D^5 on the right side and D^2 on the left. From the difference D^3 we pronounce it to be a medium degree of dulness on the right, etc. This means that the degree of dulness is underestimated and that the high degree of dulness does not have a chance of coming under observation.

This defect comes to light when we examine the casuistries, even of such a famous investigator as Turban.[7] This author, who, like so many others, recommends—with some reserve—the symmetrical-comparative method, has in the definition of a severe lung affection[8] included among other determinations a high degree of dulness. Now, when we peruse the 106 cases in Turban's third stage, among which many severe cases of lung affection are to be found, we might naturally expect to find a high degree of dulness frequently registered. This is, however, not the case. As a rule, about 250 times, only "dulness" has been registered, without assigning the degree of dulness; about 50 times we find "slight dulness" or other expressions indicating a low degree of dulness, and only five times do we find a high degree of dulness registered.

When in cases of tuberculosis of the lungs we hear of different degrees of dulness, a low, a medium, and a high degree of dulness, short tone, etc., there seems, as a rule, to be no exact notion of what it is that is dull, whether it is the whole complex of sounds, the percussion sound as a whole, or only a part of it, and in that case which. In most cases an analysis of the sound complex is not resorted to, but it is considered sufficient to pronounce judgment on the sound, as a whole, as more or less dull. Thus, it seems to be a common procedure to compare the degrees of dulness at symmetrical spots of, for example, a non-tympanitic sound on one side and a tympanitic sound on the other. It can readily be understood that in this or similar procedures most unreliable results may be yielded by the percussion, and the investigators may be startled when they proceed to auscultation by the occurrence of contradictory phenomena, such as rales, highly audible, prolonged expiration, etc., in places where no dulness whatever or only slight dulness was previously found.

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[6] C. E. Waller, loc. cit. As we know, Turban has previously proved that the respiratory sound also in the case of tuberculosis of the lungs is, as a rule, abnormally formed on both sides, at least at the apices. This fact, as well as the points to which I have drawn attention regarding the dulness, bear out the view that tuberculosis of the lungs is a double-sided disease even at an early stage, though, as a rule, it attacks one lung somewhat more than the other.

[7] Beiträge z. Kenntniss d. Lungentuberkulose, Wiesbaden, 1899.

[8] Loc. cit., p. 31.

In order to get a suitable basis from which to investigate the degree of dulness it is necessary, before the symmetrical-comparative percussion is undertaken, first to observe and study the character of the percussion sound, to see whether it is non-tympanitic, tympanitic, dull, or clear, etc. Among the percussion sounds which are to be heard from the lungs, three principal kinds may be distinguished: (1) The non-tympanitic sound; (2) the tympanitic sound which is to be heard, for example, over relaxed lungs, the relâchement tympanitic sound; (3) the tympanitic sound heard over a cavity, which is of the same nature, though not of the same pitch, as the percussion sound from the trachea, or what we may call the tracheal tympanitic sound.

The percussion sound from normal lung tissue includes in a great measure the so-called non-tympanitic sound, characteristic of normal lung tissue, which has long been known. Now, can this sound, the normal lung sound, serve as a basis for determining the degree of dulness?

If we follow the vicissitudes of the non-tympanitic sound in different stages of the development of lung tuberculosis, from the incipient stage to cavity formation, we find the following results: The clear non-tympanitic sound which is heard under normal conditions upon a slight tap (*e.g.*, in the lateral part of the fossa infraclavicularis), becomes first somewhat or distinctly short and is at the same time commingled more and more with the tympanitic sound, characteristic of relaxed lung tissue. This latter sound can thus be heard at a certain stage of development from a part (the beginning) of the inspiration and (the end) of the expiration, while the non-tympanitic sound is still heard from another part (the end) of inspiration and (the beginning) of the expiration. When the development has proceeded further, the non-tympanitic sound is no longer heard in ordinary respiration at any part of the phases of respiration, but in forced respiration it is still heard at the end of the inspiration and the beginning of the expiration.[9] All these variations belong to the incipient stage of tuberculosis of the lungs and form together what we should place under the heading of "slight dulness." As the process goes on, the non-tympanitic sound is inaudible upon a slight tap, even if the respiration is forced. It has as it were fallen out of the game beyond the range of slight percussion, but during the next stage of development it can be produced by augmenting the strength of the percussion. For in proportion as the process goes on with increasing infiltration, it will be necessary to increase the strength of the percussion to produce the non-tympanitic sound, until at last it is no longer heard even following a sharp (not, of course, a violent) tap. This latter symptom corresponds to the stage of the permanent infiltration with or without incipient softening. In the final, the cavity stage, the non-tympanitic sound is still inaudible even upon a sharp tap. In this stage the tracheal tympanitic sound, with its well-known sound-variation phenomena, enters on the scene.

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[9] This seems to answer to what Aufrecht terms "Umkehr des Perkussionsschalles." See p. 137 in his book Pathologie und Therapie d. Lungenschwindsucht, Vienna, 1905.

On the basis of these sound variations, that is, the behavior of the non-tympanitic sound upon percussion of different degrees of strength, I have founded a new method of percussion for determining the degree of dulness. It is distinguished from the old method mainly by the fact that the degree of dulness in cases of lung tuberculosis is not judged according to the degree of dulness in the percussion sound as a whole, but only in a certain part of it, that is, the non-tympanitic sound.

In 1903 I pointed out for the first time—in the Swedish Medical Society at Stockholm—the shortcomings of the symmetrical-comparative method and described my own method of percussion. In the following year this was published in the periodical of the society, *Hygica*. I shall now give, with the utmost brevity and conciseness, a sketch of that method, with the additions and modifications which have proved to be necessary in the course of its development.

This is how it runs in summarized form:

1. *Weak Percussion:* (*a*) The non-tympanitic sound is heard throughout the respiration, though somewhat or distinctly short: First degree of dulness (sign: D^1).[10] (*b*) The non-tympanitic sound is heard only during a part of the respiration, when the breathing is ordinary or forced: Second degree of dulness (sign: D^2). (*c*) The non-tympanitic sound is quite inaudible. The strength of percussion is increased to

2. *Medium Percussion:*[11] (*a*) The non-tympanitic sound is heard: Third degree of dulness (sign: D^3). (*b*) The non-tympanitic sound is not heard. The strength of percussion is increased to

3. *Strong Percussion:* (*a*) The non-tympanitic sound is heard: Fourth degree of dulness (sign: D^4). (*b*) The non-tympanitic sound is not heard: Fifth degree of dulness (sign: D^5).

By this new method, for some years employed by a number of Swedish doctors, it is not merely possible to determine the different degrees of dulness with greater accuracy, so that, for instance, a difference in the degree of dulness from one examination to another can be more exactly determined, and the different degrees of dulness, even the higher ones, be more correctly estimated: the method also enables the examiner to detect without any great difficulty an incipient dulness at an earlier stage than is now generally the case. Moreover, when this method is employed, different examiners are, relatively speaking, much more in agreement in their determination of the degree of dulness present than they were before. The results can, furthermore, be arrived at without recourse being had to the symmetrical-comparative method. The latter method of percussion consequently should be relegated to a subordinate place, just as the analogous symmetrical-comparative method of auscultation is employed in conjunction with, but subsidiary to, the method of auscultation.

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[10] This simpler designation corresponds to those first proposed: slight, slight relative, almost relative, relative, and strong relative, which were discarded as unsuitable.

[11] As the expressions "medium" and "strong" percussion might possibly convey the impression that a really strong tap was intended, such as is still sometimes heard, for example, when percussion is being demonstrated to an audience, I should perhaps have used the terms "less weak" and "still less weak," etc., in order to emphasize the importance of weak percussion, but from linguistic considerations and presuming that no practitioner who really knows his business will misconceive me, I prefer to retain those I have used above.

Beyond the range of the five degrees of dulness enumerated above lies the degree of absolute dulness, that is, the percussion phenomenon we meet with in cases of pleuritic exudations, well known to the medical practitioner.

In view of the known difficulties presented by percussion in the supraclavicular and supraspinous fossæ, as pointed out by Tsak Jundell in a noteworthy monograph,[12] and by others, the following practical advice may be given to anyone intending to adopt the new percussion method. Begin the percussion of the back and the front not at the fossæ above mentioned, but at the places which, under normal conditions, yield a clear and full percussion sound, namely, in front of the infraclavicular fossa somewhat laterally to its centre, and on the back in the neighborhood of the angle of the scapula in the infrascapular space or in the trigonum stetoscopicum.

Having as a preliminary carefully noted the character of the percussion sound—its degree of dulness in accordance with the new method—at the points just mentioned, we can then go on to percuss at the supraclavicular fossa, etc., first on one side and then on the other, at the front, on the side, and on the back.

Percussion of the back offers special points of interest. If on beginning, for instance, at the trigonum stetoscopicum on the left side one finds the non-tympanitic sound, and then proceeds making the percussion from below upward, being careful to notice when this sound is no longer heard at a slight tap (is superseded, for instance, by the relâchement tympanitic sound), he will find, as a rule, on applying the same method of percussion on the other, the right side, that the limit of the audible non-tympanitic sound reaches higher up on the side where a lesser degree of dulness is heard in front in the infraclavicular fossa. Thus, for instance, if D^4 has been found in the left infraclavicular fossa and D^5 in the right, the said limit will be found on the back to reach somewhat higher up on the left than on the right. This is such a regular occurrence (save only in the case of the crossed dulness described by Turban[13]) that this percussion phenomenon can serve to check the accuracy of the determination of the degrees of dulness in front in proportion to each other.

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[12] Bemerkungen zur Percussion der Lungenspitzen, Zentralblatt f. innere Medizin, 1904, No. 17.

As in ordinary cases of tuberculosis of the lungs, the higher degree of dulness is to be sought in the upper part of the lungs, and the degree of dulness, as a rule, diminishes from above downward, it will in many cases be found quite sufficient for practical purposes, for example, for determining the stage which the disease has reached, for comparison of the state on other occasions of examination, etc., to register out of the whole result of the percussion only the following points: In front the degree of dulness in the infraclavicular fossæ on both sides (in the supraclavicular fossa the degree of dulness is often the same as or merely one degree higher than in the infraclavicular fossa; of course, if the difference is greater, it should be entered, for example infraclavicular fossa D^2, supraclavicular D^4); and on the back the position of the said limit of the non-tympanitic sound (for example, at the line of the spinous processes of the different vertebræ).

It was noted above, as one of the defects of the ordinary symmetrical-comparative method of percussion, that a high degree of dulness is but rarely observed, and examples were given from Turban's casuistries. By way of comparison and as a proof that the new percussion method yields much more trustworthy results I may be allowed to point out that after the examination of the same number of diaries (106), (taken in numerical order and thus not selected) dealing with patients likewise in Turban's third stage (at the Halahult Sanatorium, 1907), a slight degree of dulness (D^1 and D^2) was found registered 35 times, a medium degree of dulness (D^3) 94 times, and a high degree of dulness (D^4 and D^5) 133 times. Analogous results, likewise decidedly in favor of the new method of percussion, have also been obtained by a similar comparison made as regards patients in Turban's first and second stages.

Opinions may differ as to the suitability of the number of degrees of dulness. Some consider three degrees sufficient, for example, weak, medium, and strong; others perhaps would content themselves with two, weak and strong. There are, however, grounds—apart from the facility which it would afford for finer shading—which speak for the suitability of a somewhat greater number. By subdividing the slight dulness into two degrees (D^1 and D^2), greater attention is bound to be drawn to slighter degrees of dulness, which consequently will not so readily escape observation. The medium degree of dulness (D^3), which is of such frequent occurrence both in milder and in more severe cases of lung affection, should, of course, exist as a separate category. Finally, the two degrees of strong dulness (D^4 and D^5), cannot but be differentiated, and that for a special reason. It is in the fifth degree of dulness (D^5) that the phenomena of sound variation, noticed long ago by Wintrich and others, are almost exclusively (according to calculation in more than 90 cases out of 100) to be found. Wherever D^5 occurs those phenomena must be looked for. The fifth degree of dulness consequently constitutes in itself a reply to the hitherto unanswered question: In what cases may the sound variation phenomena be looked for? Indeed, with this clue to guide us, the phenomena are met with much oftener than formerly, when it was, as it were, quite by accident that one came across them. In Turban's casuistries, above referred to, of the 106 cases in the third stage, we find "Schallwechsel" mentioned 8 times. If we examine an equal number of cases (taken in numerical order) in the same stage from the Halahult Sanatorium, 1907, we find Wintrich's phenomenon entered 37 times (not counting 5 dubious cases). The difference would doubtless have been still greater if the Halahult cases had been as far advanced as the Davos cases, which, judging by other symptoms, seems nowise to have been the case.

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[13] Loc. cit.

There is another circumstance, however, which must have contributed in some measure to the detection of such a comparatively large number of cases of Wintrich's phenomenon, and that is the employment of a new technical detail in percussion. The indirect percussion of the lungs, as we know, should, as a rule, be made with a slight tap on the plessimeter firmly pressed against the chest wall. There is one exception to the rule as to a slight tap, that is, the mode of percussion mentioned above for determining the higher degrees of dulness (D^3, D^4, and D^5). There is likewise an exception to the rule as to the plessimeter being pressed firmly against the chest wall, that is, when percussing for the tracheal tympanitic sound. For that sound comes out more plainly, purer, and less obscured by or mixed with other sounds if the examiner does not press the plessimeter finger (the author employs finger-finger percussion almost exclusively) firmly against the underlying structures, but, holding it straight and firm by its flexor and extensor tendons allows the ball of the finger to pass with the utmost lightness over the skin, while with the hammer-finger (the top or ball of the finger) he percusses "staccato" on the back of the last phalanx of the plessimeter finger. With the aid of this technicality it will often be comparatively easy thoroughly to percuss the entire region (for example, the supraclavicular and infraclavicular fossæ), where the tracheal-tympanitic sound and its sound-variation phenomena occur. This sound and its variations in ordinary cases of tuberculosis of the lungs will at first be observed on tapping the clavicle.[14] Direct percussion on the clavicle with this object in view is performed not by percussing as usual with the top of the finger (Fig. 1) but with the ball of the finger (Fig. 2).

CONCLUSION. 1. By noticing the varying character of the non-tympanitic sound upon different strengths of percussion, dulness can be detected and its degree established with greater certainty and quite independently of the symmetrical-comparative percussion method.

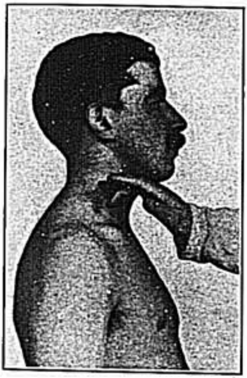

FIG. 1

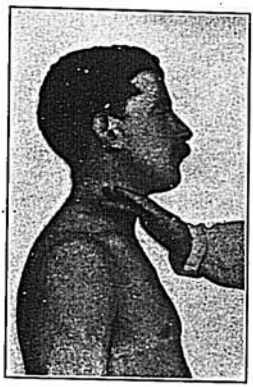

FIG. 2

FIG. 1.—Showing how the fingers should be held in ordinary direct percussion. Finger-top percussion.

FIG. 2.—Showing how the fingers should be held in direct percussion of the tracheal tympanitic sound. Finger-ball percussion.

2. The symmetrical-comparative percussion method, as usually applied, is inadequate and misleading for the determination of the presence and the degree of dulness; it should, therefore, be dislodged from the prominent position it now occupies.

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[14] Naturally not to be confused with the similar percussion sound from the trachea.